Title: Computer-supported collaborative problem solving in a primary school mathematics classroom

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matter, Plan lesson carefully; and Use clear and precise language. The teacher traits considered most important were being Sincere, Fair and Friendly. In general the views expressed by trainee teachers in Singapore are in line with the research findings related to effective teaching elsewhere.

Recommendations
The results of the present study suggest that the trainee teachers are well aware of the practices and personality characteristics that promote effective teaching. But knowing them is not enough. They have to be translated into practice in the actual classroom situation. Beginning teachers will have to be guided in this matter. Senior master teachers in the schools can help beginning teachers in this respect. Another approach that might be used would be to encourage beginning teachers to monitor their teaching and get regular feedback from their peers and students on their teaching.

The culture of getting feedback from peers and students needs to be cultivated in schools to improve one's practices and actions in the classroom. The ultimate goal should be to produce reflective teachers who reflect on their practices and take appropriate steps to improve their teaching quality.

References

Computer-Supported Collaborative Problem Solving in a Primary School Mathematics Classroom

Tan Seng Chee and Ahmad Ibrahim

Introduction
Developing student’s problem solving ability is one of the main concerns to many mathematics teachers. However, many students do not believe mathematics is applicable to solving real-world problems (Lesh, 1983). The use of decontextualised and simplified problems coupled with ineffective problem-solving instruction could be the underlying reasons.

One way to address this concern is to design authentic problem-rich learning environments that allow sustained exploration by the students. These authentic problem scenarios can be provided through an approach known as Anchored Instruction (Cognition and technology Group at Vanderbilt, 1990, 1992). In essence, Anchored Instruction makes use of data-embedded digital video to represent authentic ill-structured problems that serve as the focus of problem solving for students. 111-structure problems do not have a single solution or a single best method of solving the problem. Using collaborative problem solving is more appropriate here as the learners challenge one another with questions, use evidence to support their ideas and present multiple perspectives. We believe that a Computer-Supported Collaborative Learning (CSCL) environment like Knowledge Forum (Scardamalia et al., 1989; Scardamalia & Bereiter, 1996) can complement anchored instruction by providing scaffolding for meaningful discourse. As a result of scaffolded assistance, students are able to work at a higher cognitive level within their zone of proximal development (Vygotsky, 1962) to internalise strategies and skills.

This is an exploratory study to investigate how video-based anchored instruction and computer-supported collaborative learning environment might affect student’s problem solving performance.

Research Questions
This study is designed to answer the following questions:
• Does anchored instruction affect student’s mathematical problem solving process?
Does computer-supported collaborative learning and scaffolding help learners in their mathematical problem solving during anchored instruction?

Methods
The study was conducted with 18 boys and 27 girls from a Primary Six class in a neighbourhood school situated in the northern part of Singapore. The pupils were divided into high-achiever, middle-achiever and low-achiever groups according to their continuous assessment results. There were altogether 9 groups with 5 members in each group.
The QuickTime video "Planning a Class Outing" was produced for this study. It utilises Anchored Instruction approach by presenting a challenging ill-structured problem through a story about some pupils planning a class outing. The pupils are to select the appropriate transport vendor and work out the cost. There is no single best solution and the pupils have to justify their answers.

Before the treatment, the pupils were trained on the use of Knowledge Forum. The pupils were told not to engage in face-to-face discussion during the problem solving but to discuss ideas only through Knowledge Forum. To facilitate this, team members were distributed away from each other.

Four groups of pupils were provided with scaffolds during discussion, which included cognitive prompts like "I will include in this proposal", "I calculate the bus capacity by", and "I calculate the number of people by". The other five groups of pupils participated in non-scaffolded discussion. The process consisted of 2-hour sessions each on five consecutive days.

Results

The pupils' problem solving performance was assessed using Jonassen's ill-structured problem solving process model (Jonassen, 1997) in the following sequence:

- Articulating problem space and contextual constraints,
- Identifying and clarifying alternative options, positions, and perspectives,
- Generating possible solutions and
- Assessing the viability of alternative solutions by constructing arguments and articulating personal beliefs.

The model answer was constructed to reflect how an expert would solve the problem. Marks are allocated for each sub-step in the problem-solving process. One point was awarded for every inclusion of a correct sub-step. Since there were only nine groups of pupils involved, comparison through computation of statistical significance of mean scores was not appropriate. Table 1 serves only as a summary of some of the key results.

Table 1
Comparison of mean scores among different achiever groups and groups with scaffolding and without scaffolding

<table>
<thead>
<tr>
<th></th>
<th>High Achiever</th>
<th>Middle Achiever</th>
<th>Low Achiever</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score (%)</td>
<td>27.0</td>
<td>17.5</td>
<td>16.0</td>
</tr>
<tr>
<td>Scaffolding</td>
<td>75.0</td>
<td>48.6</td>
<td>44.4</td>
</tr>
<tr>
<td>No Scaffolding</td>
<td>47.2</td>
<td>27.8</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Several patterns are apparent from the results. The high achievers scored better than the low achievers at every stage of the problem solving process and in the mean total scores.

The groups that had scaffolded discussion performed better compared to groups without scaffolding. The results provide some indication of the effects of scaffolding, as the performance of middle achiever groups with scaffolded discussion was comparable to those of the high achiever group without scaffolding. Likewise, the low achiever group that had scaffolded discussion outperformed the middle-achiever groups that had no scaffolds. Qualitative analysis of the discourse also revealed that (1) the scaffolded groups were better in identifying, selecting and assembling most of the relevant problem-related data; (2) heuristic skills were evident in the high achiever groups; and (3) all the groups did not fully explore and construct multiple problem spaces by discussing alternative views and perspectives.

Conclusions

Anchored Instruction has been demonstrated to be an effective approach for instruction of mathematics while engaging students in solving authentic problems, but it requires substantial amount of scaffolding from the instructor. The results in this study demonstrate the feasibility of scaffolding through computer-supported collaborative learning environments like Knowledge Forum. This exploratory study demonstrated the claim that CSCL programme could provide structure and cognitive prompts that model and support group discussion, and thereby offer an alternative approach for facilitating mathematics instruction through Anchored Instruction.

References


